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《产业生态学报》
2001 年冬，第 5 卷第 2 期，13-36 页

题目：供应链上环境影响的分析与管理

作者：Adam C. Faruk, Richard C. Lamming, Paul D. Cousins, Frances E. Bowen

关键字：环境影响分析，供应链绿色化，集成供应链管理，战略管理，简化生命周期评价

摘要：本文分析了产品供应链各个环节的环境影响并探讨了相应的环境管理方法。文中首次提出了一个称为“生态供应链分析”(EcoSCAn)的管理工具。其结构与简化生命周期评价有些类似，但实际操作和用途却截然不同。EcoSCAn 是一个对不同产品的类似功能进行环境分析的工具。分析既可包含整个供应链也可集中于供应链的某一环节，既可局限于一项产品也可扩展到一个生产企业。分析结果表现为一系列信用指标。在数据质量得以保证的前提下，企业可据此进行有效的供应链管理。即使整个生命周期的信息无法完全准确的得到，企业仍能采取适当的措施以减少环境压力。

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Analyzing, Mapping, and Managing Environmental Impacts along Supply Chains

Adam C. Faruk, Richard C. Lamming, Paul D. Cousins and Frances E. Bowen

KEYWORDS:
environmental impacts mapping, greening the supply chain, integrate chain management, strategic management, streamlined life-cycle assessment

SUMMARY:
This article reports on research toward a pragmatic and credible means for analyzing, mapping, and managing environmental impacts along supply chains. The results of this research include a management tool called "ecological supply chain analysis" (EcoSCAn) that is presented here for the first time. Its structure bears a passing resemblance to that used in some streamlined life-cycle assessments, but its operation and purpose are quite different. The EcoSCAn tool frames a comparative environmental analysis of products capable of performing broadly equivalent functions. The analysis occurs over complete extended supply chains and within defined supply chain stages at a product level ant, to some extent, at a site level. The results are mapped with data confidence indicators,. A range of tactical and, where data quality is sufficient, strategic supply chain actions are prompted. Actions to mitigate environmental stress are possible in the absence of good quality data across entire product life cycles, although the extent to which management actions are limited is made plain.

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题目：水资源的生命周期影响评价：相关指标的选择

作者：J. W. Owens

关键字：环境指标，生命周期评价，可持续性，水，水消费，水质

摘要：在生命周期评价(LCA)中，水既是一种资源也可能是一种污染物。从可持续的角度来看，现有的水资源评价指标存在着不足。更先进的反映水资源可持续性的指标应包括两个关键部分：水量和水质。从水量的角度考虑，LCA 输入端的水资源是取之不尽和可再生的，而 LCA 输出端的水量仍可为下游的生态或社会系统所继续使用。从水质的角度考虑，回水的再利用必须无损于人类或生态系统的健康。与水量相关的评价指标包括：水资源消费量，水资源的消耗过程的可持续或不可持续性等。影响水质的因素则有很多，LCA 过程的选择、技术上的挑战等等，都为水质指标的确定增加了难度。指标的选择必须充分考虑到该指标所关心的问题及所能提供的有助于决策的信息的准确度。考虑到 LCA 的研究对象和研究目的差异很大，建立一套单一的普适的水资源评价指标是不可能的。本文所提议的水量和水质评价指标必须与具体的环境管理系统相一致，确保不存在数据冗余和数据歧义的问题。

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Water Resources in Life-Cycle Impact Assessment: Considerations in Choosing Category Indicators

J. W. Owens

KEYWORDS:
environment indicator, life-cycle assessment, sustainability, water, water consumption, water quality

SUMMARY:
Water is one of many resources, wastes, and pollutants considered in life-cycle assessment (LCA). The widely used indicator for water resources, the total input of water used, is not adequate to assess water resources from a sustainability perspective. More detailed indicators are proposed for water resources in two areas essential to water sustainability: water quantity and water quality. The governing principles for a consideration of water quantity are that (1) the water sources or LCA inputs are renewable and sustainable and (2) the volume of water released or LCA outputs are returned to humans or ecosystems for further use downstream. The governing principle for a consideration of water quality is that the utility of the returned water is not impaired for either humans or ecosystems downstream. Water quantity indicators are defined for water use, consumption, and depletion to reveal the sustainable or nonsustainable nature of the sources. A flexible set of water quality indicators for various factors that may impair water quality are then discussed, including the LCA study choices, technical challenges, and trade-offs involved with such indicators. Indicator selection from this set involves the underlying concern or endpoint represented by the indicator and the level and accuracy of decision-making information that the indicator must provide. With significant differences in emissions among systems studied using LCA and different purposes of the LCA studies themselves, a single, default set of water quality indicators applicable to all systems studied with LCA is problematic. The proposed water quantity and quality indicators for LCA studies are also intended to be compatible with environmental management and reporting systems so that data needs are not duplicated and interpretation for one does not contradict or sow confusion for the other.

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题目：面向产品的环境管理：全面质量管理的参考经验

作者：Frank G. A. de Bakker

关键字：持续改进，生命周期管理，产品照管，责任关怀，风险承担者，全面质量管理(TQM)

摘要：环境管理在企业经营过程中的地位日益重要，传统的面向过程的环境管理正逐渐向面向产品的管理转变。本文将探讨面向产品的环境管理(POEM)这一有待加强的研究领域。产品导向型环境管理将改善企业产品或过程的环境性能的目标放在一个整体的战略框架下统筹考虑。文中首先介绍了 POEM 的概念，由于该概念与质量管理有一定的类似之处，又考察了全面质量管理(TQM)对 POEM 的参考价值。在综述 TQM 的概念和文献的基础上，本文进一步讨论了 POEM 可能的组成要素及 POEM 矩阵框架。应用该矩阵可有效地集合各方面的意见，进行产品导向型的环境管理并改进产品的环境特性。本文还给出了 POEM 矩阵在化学工业中的一个应用案例。

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Product-Oriented Environmental Management: Lessons from Total Quality Management

Frank G. A. de Bakker

KEYWORDS:
continuous improvement, life-cycle management, product stewardship, Responsible Care, stakeholders, total quality management (TQM)

SUMMARY:
Environmental management issues are becoming ever more prominent in business, and their focus is broadening from process orientation toward product orientation. Until now, little attention has been paid to an organizational focus on the environmental performance of products. This article therefore considers product-oriented environmental management (POEM), an approach to organizing and operating a firm in such a way that improving a the environmental performance of its products and processes becomes an integrated part of operations and strategy. First, the POEM concept is introduced. Because this concept addresses some issues similar to those of quality management, the possibility of using insights from total quality management (TQM) in developing POEM are investigated. Based on an overview of the literature and conceptual studies of TQM, a coherent set of several elements are described that can contribute to the organization of POEM. These elements are grouped in a framework, the POEM matrix, which can be used to guide research within this emerging area of organizing for the environmental characteristics of products. This matrix could also provide guidance to practitioners by delivering an integrated perspective on the organizational elements that are conducive to organizing POEM. An example from case study research in the chemical industry illustrates such an application of the matrix.

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题目：社会系统的能量代谢 II：实例分析

作者： Helmut Haberl

关键字：生物质，二氧化碳封存，能源审计，狩猎社会，初级净生产量(NPP)，可持续发展

摘要：本系列论文的第一部分探讨了进行社会能量代谢的方法。本文将利用上述方法研究具体的社会形态：如狩猎社会、农业社会(东南亚)和工业社会(奥地利)。不同的社会形态具有不同的能量代谢特性。狩猎社会的特性主要表现在“无限的太阳能输入”上，人们可在不进行生产的情况下获取食物。狩猎社会仅仅利用了生态系统净初级生产量(NPP)的 0.001%到 0.01%。农业社会对 NPP 的利用则显著提高，尽管 NPP 有所减少，但利用率则提高到 20%。因为农业社会的能源主要来自自然生态系统，因此生态系统的 NPP 是该社会能量代谢的主要约束因素。工业社会的能源主要是化石燃料和核能，不受耕地的限制，但也造成了新的环境问题，如温室气体等等。能量代谢方法可以用来统计分析社会系统的能流，是研究人类社会与自然环境关系的一种有效方法。本文对各种能量统计和代谢方法，作了研究，并探讨了其对实现人类可持续发展的意义。

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The Energetic Metabolism of Societies, Part II: Empirical Examples

Helmut Haberl

KEYWORDS:
biomass, carbon sequestration, energy accounting, hunter-gatherers, net primary production (NPP), sustainable development

SUMMARY:
Part 1 of this set of articles proposed methods to account for the energetic metabolism of societies. In this second part, the methods explicated in Part 1 are used to analyze the energy flows of societies with different “modes of substance”: hunter-gatherers, a contemporary agricultural society in south-eastern Asia, and a contemporary industrial society (Austria). The empirical examples are used to demonstrate differences in the “characteristic metabolism” of different modes of subsistence. The energy system of hunter-gatherers can be described as an “uncontrolled solar energy system,” based mainly upon harvesting biomass without attending to its production. Hunter gatherers use only about 0.001% to 0.01% of the net primary production (NPP) of the territory they inhabit. Agricultural societies harness NPP to a much higher extent: Although agriculture often reduces NPP, the amount of biomass that agricultural societies use is much higher (about 20% of potential NPP). Because ecological energy flows are the main source of energy for agricultural societies, NPP strictly limits the energetic metabolism of agricultural societies. Industrial society uses area-independent energy sources (fossil and nuclear energy), which, however, result in new sustainability problems, such as greenhouse gas emissions. By providing methods to account for changes in energy flows, the metabolism approach proves itself to be a useful concept for analyzing society-environment interactions. The article demonstrates the difference between the metabolism approach and conventional energy statistics and discusses the significance of the proposed approach for sustainable development.

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题目：从摇篮到坟墓：生产者延伸责任制在不列颠哥伦比亚省家庭有害废物管理中的应用

作者：Ronald J. Driedger

关键字：工业照管，涂料回收，产品照管，产品回用，非油品，废物防治

摘要：生活有害废物(HHWs)、废杀虫剂、废溶剂、废油漆、润滑油等等都会对一个地区的固体废物管理造成影响。如果非法倾倒或添埋与焚烧处理不当的话，HHW 极易引起水和土壤的污染。通常采用的办法是把 HHW 从一般的垃圾中分离出来单独处理，但这样做的代价也很高。为此，加拿大的不列颠哥伦比亚省(BC)采取了一种基于生产者延伸责任制(EPR)的管理方法。

从 1992 年起 BC 就制订了有关废润滑油处理的相关条例，在该规定作用下每年有 4 千万升以上的废润滑油通过 EPR 系统得以回收。1994 年又通过了关于废油漆的 EPR 规定，1997 年有关溶剂、可燃液体、家用杀虫剂、汽油和药品的法规也建立了起来。

通过引入 EPR，地方政府的 HHW 管理费用显著下降。相关的 EPR 法规比传统的管理办法更为有效，促使消费者更为经济的使用可能产生 HHW 的产品。

BC 省的 EPR 管理经验包括：制定灵活的计划，提供充足的资金，创造公平的环境，并采取有效措施尽可能的提倡废物回用与回收，培养消费者的环境意识，完善监控系统，从而减少废物的产生与 HHW 的掩埋。

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From Cradle to Grave: Extended Producer Responsibility for Household Hazardous Wastes in British Columbia

Ronald J. Driedger

KEYWORDS:
industry stewardship, paint recycling, product stewardship, product take-back, waste oil, waste prevention

SUMMARY:
Household hazardous wastes (HHWs), the discarded pesticides, solvents, paints, lubricating oil, and similar products common to residences throughout the industrial world create problems for governments charged with managing solid waste. When disposed of improperly in landfills or incinerators or if dumped illegally, HHW may contribute to soil and water contamination. A most common management tool for HHW is a special collection effort that segregates HHW from normal trash and disposes of it in an approved manner, all at a higher cost to the governmental jurisdiction. The Canadian province of British Columbia (BC) has undertaken a different approach, based on the use of extended producer responsibility.

BC's efforts began in 1992 with adoption of a regulation on used lubricating oil (lube oil). More than 40 million liters (L) of used lube oil have been collected annually through the EPR system established under this regulation. A regulation establishing producer responsibility for postconsumer paints followed in 1994. BC enacted an additional regulation establishing EPR in 1997 for solvents/flammable liquids, domestic pesticides, gasoline, and pharmaceuticals.

As a result of the application of EPR to HHW, local governmental costs for managing HHW and the amount of HHW identified in municipal waste have declined. Although the regulations appear to have mixed success in prompting consumers to avoid products that result in HHW, there are indications that they may be more effective than conventional management efforts.

Based on BC's experience with EPR, key factors for successful implementation include maintaining flexibility in program design, creating viable funding alternatives, aggressive enforcement to provide a level playing field, and adopting policies that maximize diversion of HHW from landfills, while minimizing waste generation, setting targets for reuse and recycling, promoting consumer awareness and convenience, involving local government jurisdictions, and monitoring outcomes.

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题目：生物固体废物处理方法的生命周期评价

作者：Gregory M. Peters， Sven Lundie

关键字：生物固体废物，全球气候变暖(GWP)，人体毒性(HTP)，石灰调节剂，下水道污泥，废水处理

摘要：生物固体废物主要是水处理产生的污泥中分离的出来的可资利用的有机物。该固体废物有多种处理利用方法，本文利用生命周期评价工具对澳大利亚悉尼市的使用途径作了分析，重点比较了两种不同的应用情景（（1）用于脱水和石灰调节剂，（2）用于集中干燥系统）及相关技术（热干燥与石灰调理）。研究中主要考虑的环境问题包括能源消耗、全球气候变暖(GWP)和人体毒性(HTP)。

应用情景 2 的能耗较情景 1 高 24%，原因在于抽水装置要耗电以及干燥过程需要沼气和甲烷气体。由于都是集中式系统，所以二者的 GWP 和 HTP 影响相差不大。

此外，技术是一个重要的影响因素。North Head 污泥处理厂采用热干燥技术，在内生沼气的供应充足的前提下，对比石灰调节技术，其能耗只占后者的 68%，GWP 影响为后者的 45%，HTP 影响仅为 23%。

研究表明改善生物固体废物处理的关键在于选取适当的技术，其它改进措施还包括：采用沼气燃料，避免燃煤电力的使用，减少货运距离，提高污泥中固体的含量等。

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Life-Cycle Assessment of Biosolids Processing Options

Gregory M. Peters and Sven Lundie

KEYWORDS:
biosolids, global warming potential (GWP), human toxicity potential (HTP), lime amendment, sewage sludge, wasterwater treatment

SUMMARY:
Biosolids, also known as sewage sludge, are reusable organic materials separated from sewage during treatment. They can be managed in a variety of ways. Different options for biosolids handling in Sydney, Australia, are compared in this study using life-cycle assessment. Tow key comparisons are made: of system scenarios (scenario 1 is local dewatering and lime amendment; scenario 2 is a centralized drying system) and of technologies (thermal drying versus lime amendment). The environmental issues addressed are energy consumption, global warming potential (GWP), and human toxicity potential (HTP).

Scenario 2 would consume 24% more energy than scenario 1. This is due to the additional electricity for pumping and particularly the petrochemical methane that supplements biogas in the drier. A centralized system using the same technologies as scenario 1 has approximately the same impacts. The GWP and HTP of the different scenarios do not differ significantly.

The assessment of technology choices shows significant differences. The ample supply of endogenous biogas at North Head sewage treatment plant for the drying option allows reductions, relative to the lime-amendment option, of 68% in energy consumption, 45% in GWP, and 23% in HTP.

Technology choices have more significant influence on the environmental profile of biosolids processing that does the choice of system configurations. Controlling variables for environmental improvement are the selection of biogas fuel, avoidance of coal-sourced electrical energy, minimization of trucking distances, and raising the solids content of biosolids products.